slide 3
Distributed file system
-DFS-

- what are file system Management task ?
  - Naming and Locating a file.
  - Security and Protection.
  - Accessing file (read - write - delete ----).

- Meaning of Distributed file system :
  a file system with distributed storage on Multiple Machines.

- Distributed file system Requirements :
  1 - transParency ⟷ Location, Migration, sCaling
  2 - ReplicaTion
  3 - fault tolerance
  4 - security → Access Control List (file Permissions)
  4 - security → CaPability List (user Permissions)
  5 - efficiency (sPeed)

- What are Models of file service ?

file service

uPload/download Model (Cached system)

- client download the file and Make changes on it then uPload it to the server back (May cache it for future request if it's repeatedly Accessed).

advantage :
1- Reduce Networks traffic
2- fast by using cache

disadvantage :
1- client storage May be small
2- unConsistency problem between Cache and the server.

Remote Access Model (remote system)

- client execute oPeration on the server

advantage:
1- better for small storage of users
2- No Consistency Problem

disadvantage:
1- overhead Networks traffic
2- take time for every request of file.

- Comparison between Caching on disk and on Main Memory :

disk advantage : More Reliable since if sth wrong happened to Machine and it's Powered of, we don't need to fetch data again from server, we get it from disk.

Main Memory advantage : quickly Accessing data So the performance is better.

- two APProach of Consistency :
  - client-intiated : the client is responsible for check the two file one he has and the other on the server is the same.
  - Server-intiated : the server is responsible for chec

.....

- What are Cache-update Policies:

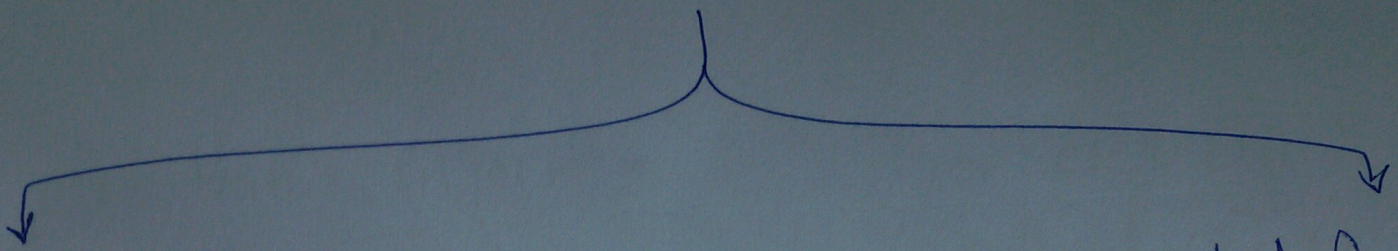
1- write-through: ~~any client Make the file Process on the Server~~ the client send any changes he Made on the file to the server immediately.

2- Delayed-write: the client Make changes on his cache and Later Send it to the Server, So if his machine crashes we Lose the data.

3- Variation 1: for every time Period, send changes to the server

4- variation 2: send file changes to the server when you close the file.

- Mention two file services states ?



stateless

No client-specific information kept on the server after user end of the session

stateful

the server has information about the client between sessions since the client has unique identifer

Failure Recovery

doesn't know if a failure happened and begin a new session when you request.

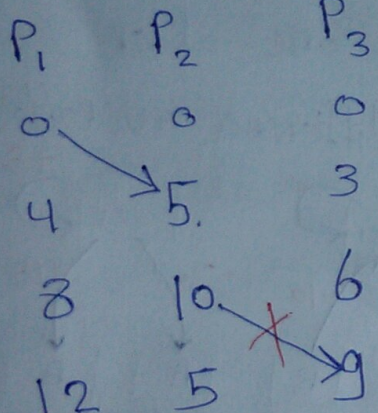
Resume your old session by restoring old state by your identifer.

slide 4
synchronization in Distributed system

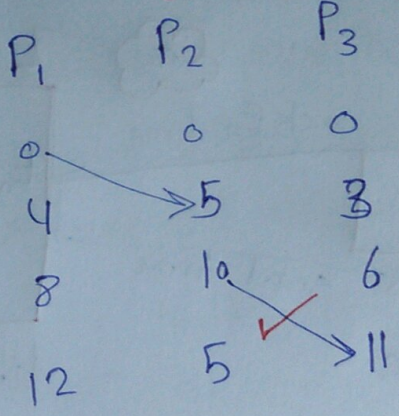
LamPort Logic clock:

when a machine send Message at t_0 to another machine at t_1 so t_1 must be greater than t_0 Logically.

wrong



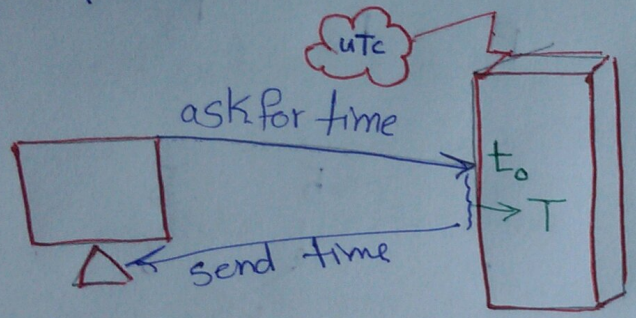
right



- two ways to maintain synchronization :

cristian's Algorithm (using uTc)

- You have a time server each machine ask him for time and he references uTc (universal cordinated time).



Assume :

RTT = ask time + Send time

&

ask time = Send time

So Send time = RTT/2

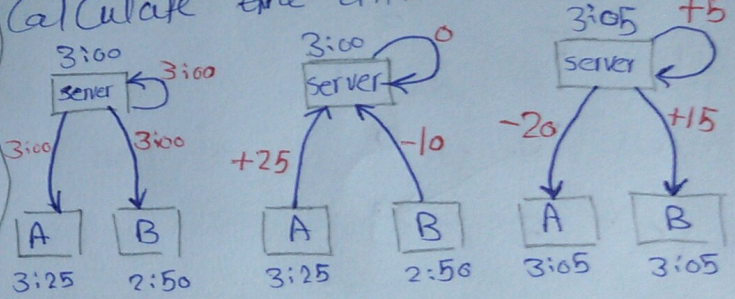
t_0 : request Arrive time

given time to Machine = $t_0 + T + \frac{RTT}{2}$

Berkeley unix (without uTc)

1- Centralized :

time server send its time to all machines and they respond by difference between them then he sends correcting time to each one after Calculate the difference average



2- Decentralized : all Machines broadCast its time and Calculate the average and Correct only its own time

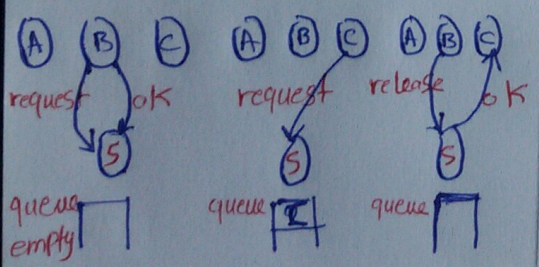
- two APProaches to Maintain mutual exclusion of shared memory :

[1] Permission [2] Token

Permission

Centralized

one Machine is elected as a Coordinator and any Machine want to access any resource asking him and he reply with ok if the resource is free and No reply and Make a machine in ~~res~~ the resource queue if it's used by another one, until it's released, then give him Permission.



advantage : • simple to implement

disadvantages : • single Point of failure
• bad Performance

Decentralized

• each resouce is replicated n times ~~and~~ with one Coordinator per replica.

• when a machine want to access some resources search by resource name in hash table when Machine have it and to have Permission to Access it Must get Permission from ~~machine~~ resource Coordinator > n/2

advantage : No single Point of failure.

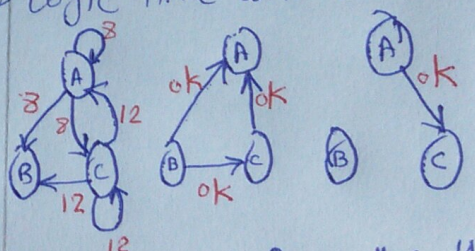
disadvantage : lots of Messages.

Distributed

• resource requestor send Messages to all Machines with its Logic time and which resouce he want.

if it's busy, he will get into queue.

if two Machine ask at the same time, the least Logic time will win.



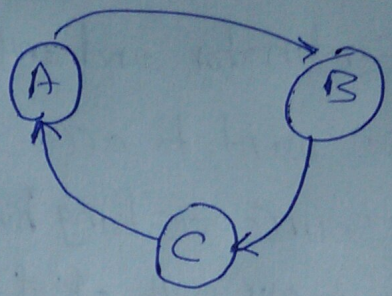
if you get ok from all so you win.

advantage : No contratization
• fewer Messages

disadvantage : n Point of failure as you have get ok Message from all.

[2] Token system

organize the processes (Machines) in a ring and Path a token through the ring, the one has the token can access any resources if it doesn't need it Path it to the successor



advantage:

- fairness (No starvation)

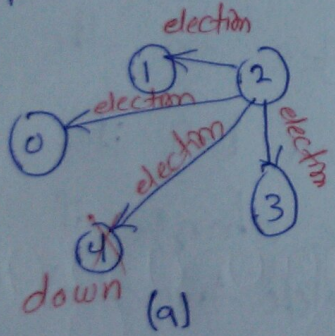
disadvantage:

- crash of a process holding token
- if token is lost, it's to be regenerated

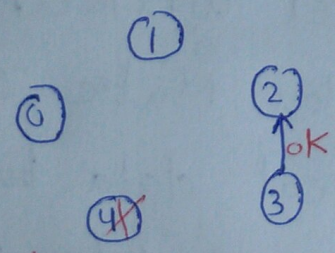
Election algorithms for Coordinator:

① Bully Algorithm

each process has a number, each one would like to be coordinator send message to upper-numbered processes and if any of them inside the election she send ok-message to it to tell it, he's alive and stop him until the biggest number when



(a)



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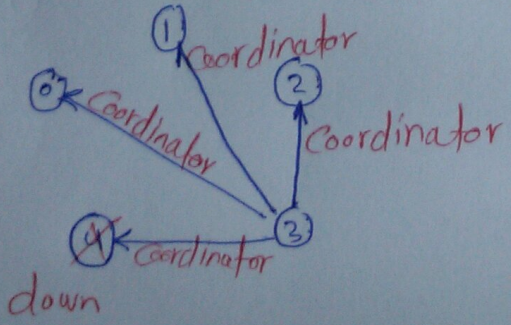
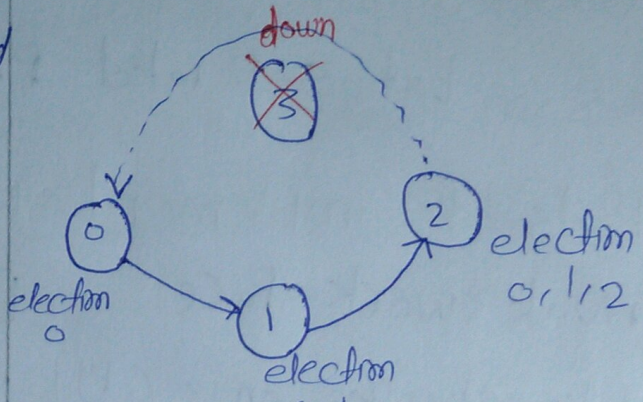
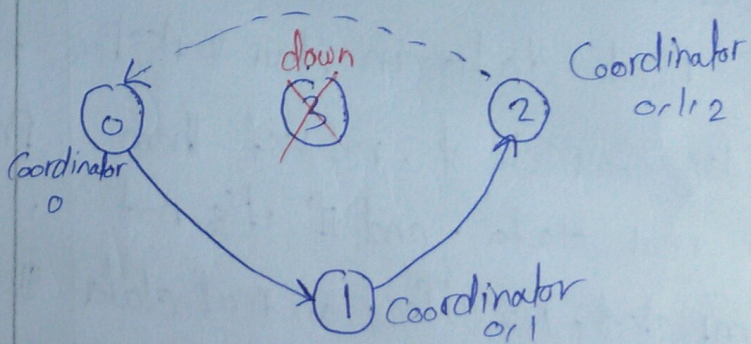
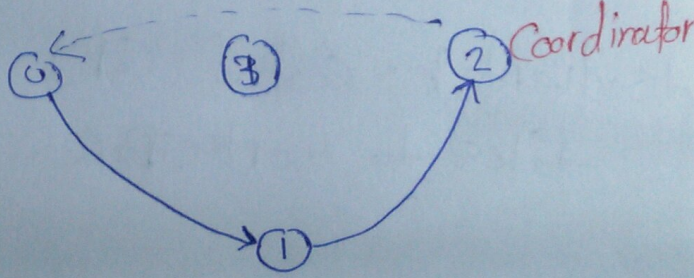


② Ring Algorithm

each process also has a number, and each one would like to be Coordinator send Message and one with highest number, win the election.





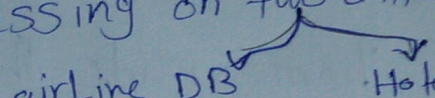


Transaction : one or more operations happens Completely (Commit) or not at all (Rollback) (ex: transfer money between bank accounts)

types of transcations:

1- flat transaction (processing on one database).

2- Nest transcation (Processing on two different DB).



3- Distributed transcation (Processing on the same DB but seperated physically)

Methods of implementing transcation:

[1] private workspace

You Make changes on a copy of real data in your workspace after complete it, reflect them on real data. and if it's not completed, No effect on real data

disadvantage: cost of copy files to workspace.

[2] write ahead Log

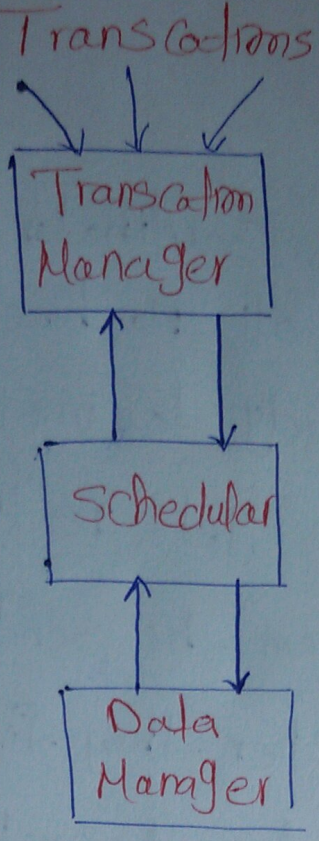
You Make changes on the real data but you Log its previous value before change, if it's aborted (not complete transcation) get back old value.

Two Phase Commit Protocol: most widely Protocol used for implement transcation in Distributed system.

Phase 1 : the Coordinator send Prepare message to all Machine to check if they are ready to implement transcation, if he get ready Messages from all of them, he send Commit order to them

Phase 2 : after they finish, they Notifie him. if he doesn't get ready message from all, the transcation is aborted (cancelled)

handling Mutual exclusion (Concurrency control) between transactions:



three Methods of Scheduling (Concurrency Control)

Lock / Release

when a process access any resource, it locks it ~~till~~ till it finishes the task, then release it, so I ensure from Mutual exclusion.

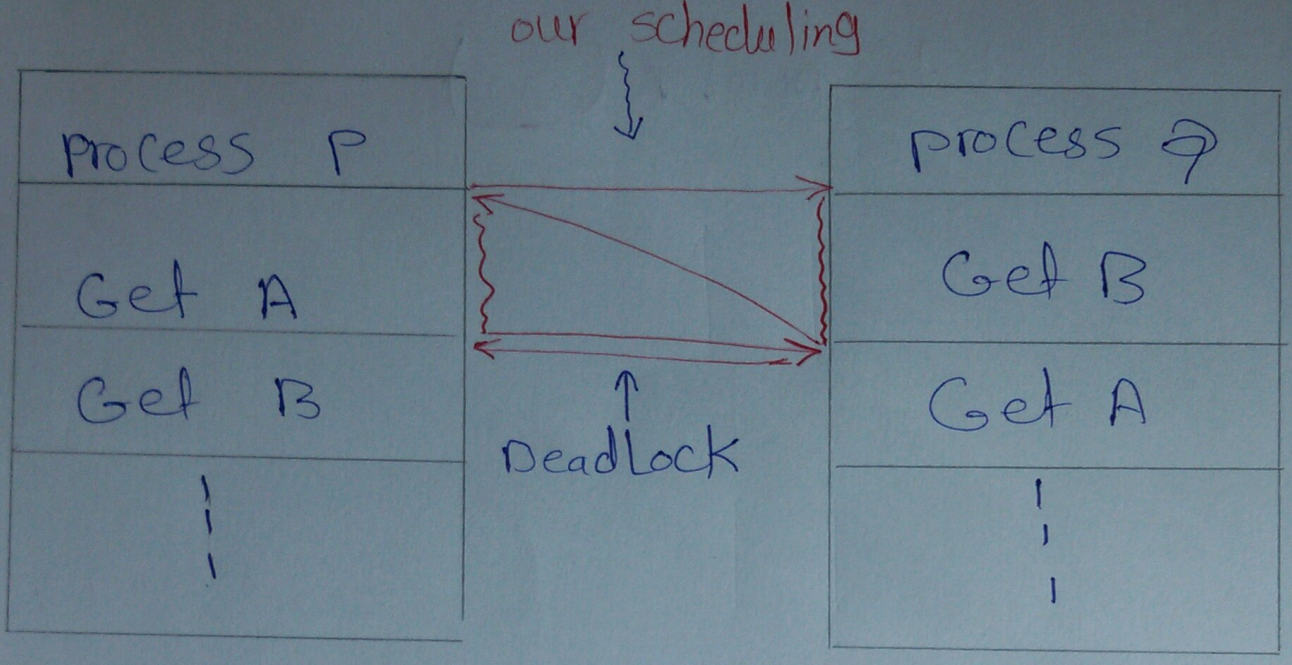
optimistic

every process assume no others works on the resources and if the resources status changed during transaction by others, the transaction is aborted, otherwise it's committed.

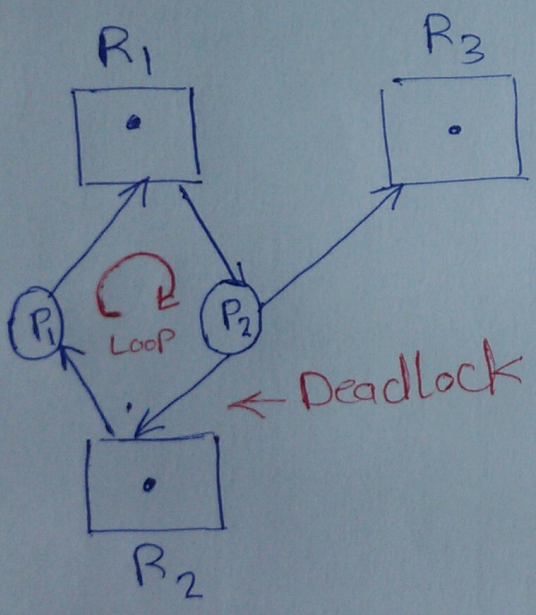
Time Stamp

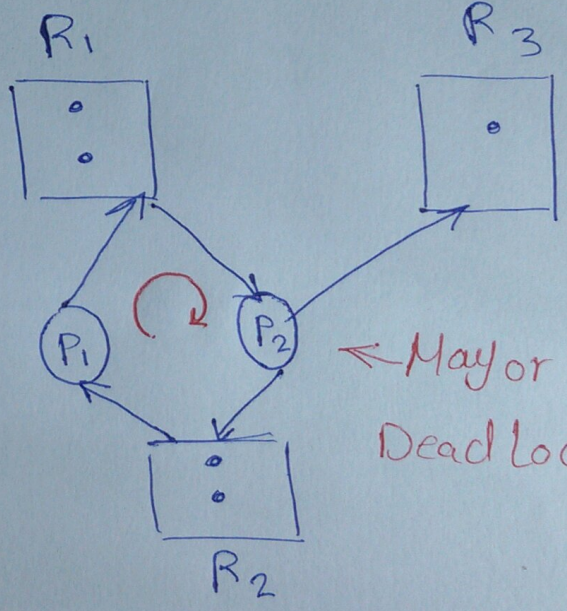
every process give the accessed resources its time stamp when accessing it, and if the resource has higher timestamp at any moment, meaning another one access it so it's aborted, otherwise it's committed.

the Deadlock problem : a process hold the Resource A and wait for the resource B which is hold by another process waiting Resource A. ::



Resource Allocation Graph





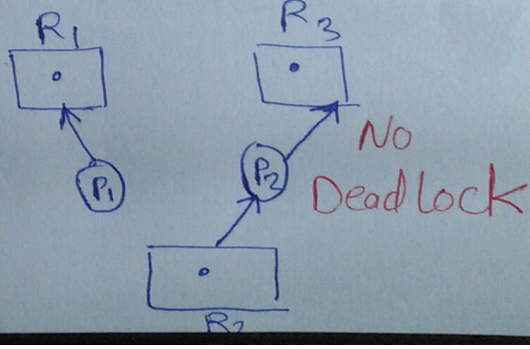
: Mean Resource

: Process

: n. of Replication

: Request resource

: resource held by this process



Dead lock Characterization

" not understanding yet "

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